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able of sustaining out of the water an equal number of men; and of conveying them on the tops of the waves, and depositing them safely on shore, or even on the surface of rocks, when the sea retired with the tide.

Rafts of this nature seem to Mr. C. to be much the best, because all others that he had heard of, have this great defect, that they come on shore with too much force, and that the blows they receive either disjoint them, or throw off the people; that their wrecks are more dangerous than the rocks they strand on; and that every time they pitch those on them are covered, some of which never may be able to retain their hold or to rise again.

Mr. Cumberland thought it a duty to humanity to lay this project before the admiralty, as with them the power of putting it extensively into practise chiefly exists, but as they did not even think fit to acknowledge his letter on the subject, we must conclude that they have treated it with the same neglect, with which they almost always treat proposed improvements, if not originating among themselves, or backed by irresistible patronage.

An Account of the Method of manufacturing Salt at Moutiers, in the department of Mont Blanc, by M. Berthier, Mine Engineer.

Continued from p. 216, *No,* XXVII.

As the rope shed is used one part of the year for collecting the salt, and even when used for graduation, it does not receive any brine weaker than 14°, the cords last a long time. There still remain three fourths of those that were put up fifteen years ago, so that it is probable that the whole will not want renewing in less than fifty years.

A boiler lasts fifteen or even eighteen years if it be taken care of, and the scales are not allowed to grow too thick, but are knocked off every twelve or fifteen boilings, in order to repair the bottom.

The persons employed are, a director, who corresponds with the committee; a general overseer; an overseer of the springs and buildings; a foreman of the boiling house; a storekeeper and salesman; several clerks, graduators; boilers, three to each furnace; carpenters, smiths, labourers, porters, wood-renders, carmen, &c. in all about 112 individuals, almost all of whom receive monthly salaries.

The salt is sold at one franc 60 cent. (16*d.*) *per* myriagramme (20lb.) The sulphate of soda accumulates in the warehouse, and is sold for whatever the buyer will give for it. The glass-houses at Annecy buy some of the last schelot and scales, but at a very low price; so that the salt is the only productive substance, and yields 160,000 francs (about 6,666*l.*) a year. The expenses are 30,000 fr. (1500*l.*) for 7000 steres of billet-wood, and 8000 fr. (333*l.* for purchasing iron, building materials, &c. besides the wages of the persons employed.

If the brine were evaporated immediately from the spring, it would require seventeen steres of wood to obtain ten myriagrammes of salt, the value of which would not be more than a quarter of the cost of the fuel. It is therefore absolutely necessary to graduate the brine. The manner in which this is done has been described above; but some other trials have been made to obtain the same end, of which hereafter. In whatever manner, however, the brine is concentrated, the free exposure of it to the air is inevitable; and from this circumstance there results a very great inconveniency, which has not as yet been attempted to be removed. This inconveniency consists in formation of the sulphate of soda, which takes place in consequence of the reciprocal decomposition of muriate of soda and sulphate of magnesia when the temperature is near the freezing point. This effect is certain: it is agreeably to the well-known principles of chymistry, and has been particularly observed at Moutiers. It is there known that in cold weather the salt that is obtained is less pure than at other times, and that the mother water is then more abundant on account of the muriate of magnesia being augmented in quantity. When this decomposition is complete, which perhaps takes place in the coldest days of winter, the brine will contain for every 100 parts of muriate of soda, as far as 22 of sulphate of soda, and

6 of muriate of magnesia, instead of 15 of the one and 3 of the other, which it holds when it first comes from the spring.

The consequences of this decomposition is very prejudicial to the establishment. 1° A part of the muriate of soda is decomposed and lost. 2°. There is obtained only a very bad salt which effloresces in dry weather, and is deliquescent when the air is moist. 3° A great quantity of wood must be used in the evaporation, which must be carried on slowly in order to collect the muriate of magnesia in the mother water.

As they do not know at Moutiers any preventive against these inconveniences, the method of graduation by frost is rejected, and the bad salt made in winter is mixed with the good salt made in summer. By this means they are deprived of a great help, as in winter when evaporation goes on so slowly, large basins exposed to the frost would assist in keeping the boilers employed if the method of purifying the brine were known.

There is a very simple and cheap method of performing this, which was discovered by *Gren*, and succeeds completely. It consists in making a cream with quicklime, and mixing this cream with the brine. All the salts of magnesia are immediately decomposed, the magnesia is precipitated; sulphate and muriate of lime are formed, and then this last salt re-acts upon the sulphate of soda, and decomposes it in its turn, so that the brine contains only sulphate of lime and muriate of soda; the quantity of the latter is even slightly augmented. But in order that this purification should be complete, it is necessary that the brine should contain a peculiar proportion between the sulphate of soda and the muriate of magnesia, which is nearly that of 100 to 55. Unfortunately this proportion does not exist in the brine from the springs, and it would still retain, after the lime had been added, about three fourths of the sulphate of soda that it previously contained. This could not be separated unless muriate of magnesia could be obtained, which is however very possible; but it would be useless, as the brine, if the deliquescent salts and muriate of magnesia were got rid of, would yield a salt as fine as any in trade. Nothing, therefore, hinders the graduation by frost.

It has been tried several times, both at Constance and Moutiers, to concentrate brine by the heat of the sun, by exposing it in basins; surrounded with iron plates in order to reverberate the heat upon the liquid, and by covering it during rain. At Salins the brine has been raised to the top of a precipice, and let to run down its face, while covered with faggots, but neither of these methods was successful. Insulated sheds have therefore been again taken up, and a great step towards perfection has been made by the invention of the rope shed, which evaporates the brine much swifter than the others. The ropes being small, close together, equally distributed, and regularly arranged, the whole length of the building, it happens of consequence, 1, that the brine runs down them in an uniform manner; 2, it is spread over a large surface, 3. it is distributed in thin layers round the chords; 4, it is not exposed to be blown away by the wind; 5, and lastly, the air circulates freely and is renewed with the utmost facility. From these favourable circumstances there can be evaporated even of saturated brine, and in ordinary weather, 68 myriagrammes (scores) of brine, or 685 decim. cub. per metre running measure, in 24 hours, while it would require the most favourable weather to produce this effect in the faggot sheds, which are only used to concentrate weak brine. The maximum is 70 myriagr. or 700 decemet cub. in 24 hours in a metre running meas. or a surface of between eight or nine metres square. The sheds with faggots have many essential defects 1° Whatever care is taken of the arrangements of the faggots they cannot be uniformly distributed; so that in some places the graduation of the brine does not take place; in others it goes on properly, and in others the brine is blown away by the wind. 2°. The brine running upon them from a single gutter placed lengthways, it only occupies a very small portion of the breadth of the shed, and, of course, does not offer so large a surface to the wind as the ropes.

3°.. and lastly, when the thorns become covered with a thick crust of sulphate of lime, they form a solid mass, the graduation does not go on well, and the shed is in very great danger of being blown down the first storm of wind.

The rope shed is then, in every respect, preferable to those with faggots. It has as yet not been employed in any salt work but that of Moutiers. Experience also confirms this theory, and has shewn that with a shed of the same size, twice as much brine can be evaporated by the former as by the latter. Its only defect is, that it is expensive to erect (that at Moutiers cost 30,000 francs, or 1250*l.*) but it appears that it did not require much repairing. At present, it is not used to graduate weak brine for fear the cords should rot too fast; but it is probable that a varnish might be prepared which would cover them and preserve them from this destruction.

In the present state of affairs, which does not admit of the purification of the graduated brine, the management of the fire is properly conducted. A brisk fire is necessary at first because less fuel is consumed by it, in evaporating the same quantity of water, than with a small fire; it also gets through the evaporation quicker, and separates along with the schelots, &c. about a fifth of the sulphate of soda, which probably would not happen if the evapoartion were conducted slowly by a low temperature. Indeed, it occasions a loss of about 1-45th of the muriate of soda, which goes off along with the schelot and scales; but this inconveniency depends upon the impurity of the brine. When the schelot is separated, a small fire becomes indispensable in order to separate the greatest part of the muriate and of the sulphate of magnesia which is left in the mother water, and which would crystallise along with the muriate of soda if the boiling were continued.

It may be seen by the analysis of the products as given in this paper, that the precipitation of the sulphate of soda diminishes considerably immediately after the schelotage, that it afterwards augments gradually on account of the water being saturated with it, and that it is entirely separated before the evaporation is ended. The last made salt contains only sulphate of magnesia; that made towards the latter end of a boiling contains besides this 1-10th of its weight of sulphate of soda. The mixt salt must contain at least as much of foreign matters.

It follows from this, that the attraction of the different salts is considerably augmented by the temperature, and that the mixture of them when they are precipated, depends much more on the heat employed in the evaporation, than on its promptitude; so that the collection of the salt upon the ropes yields a much purer salt than that of the boilers, although it is made in one fourth or fifth of the time.

This method, besides the advantage of saving one half of the fuel, is therefore to be recommended for the treatment of brine containing several salts; but in this case care must be taken to raise a large quantity of brine at a time, and to stop the evaporation at the precise moment when the foreign salts begin to precipitate in too large a proportion. This point of time is usually indicated by the appearance which the brine assumes. It becomes thick, viscous, and what is called fat, the mixt salts that it contains deliquesce on account of the muriate of magnesia being among them, and will not crystallise, but yield only a saline mass which is very difficultly dried.

To be Continued.

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